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Mobile Commerce: Assessing New Business Opportunities

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ABSTRACT

Mobile commerce has become the latest topic for today. Business organizations have been restlessly evaluating the revenue potential of the m-commerce market and developing business models to exploit the huge profit potential of this new market. In this project we try to provide an overview of the fundamentals about m-commerce. This paper attempts to help business managers, particularly those without IT background, to understand the key elements and basic concepts of m-commerce and to assess the impact of m-commerce on current and future businesses as well as to identify new business opportunities.

INTRODUCTION

While electronic commerce continues to see phenomenal growth, mobile commerce is still in its infancy. However, as wireless network grows, it is expected that emerging wireless and mobile networks will provide new avenues for growth in mobile commerce, create new business models for mobile operators and offer new applications to business and consumers (Coursaris and Hassanein, 2002, Kumar and Zahn, 2003).

According to the GartnerGroup, consumer to business e-commerce will soon come from smart phones using mobile commerce technology. Many researchers suggested that next phase of electronic business growth will be in wireless and M-commerce (Ngai and Gunasekaran, 2007, Smith, 2006, O'Connell, 2005, Matthew, et al, 2004, Urbaczewskj, et al, 2003). To better understand the potential impacts of mobile commerce on businesses, a quick review of definition and background information about it would be helpful.

M-Commerce is also known as mobile electronic commerce or wireless electronic commerce. It is believed to be the next gold rush after e-commerce. Business organizations of different industries are rushing to stake a claim (Stafford and Gillenson, 2003). However, m-commerce is many things to many people. Some people conceive m-commerce as an extension of e-commerce to mobile phones. Some people think it is another new channel after the Internet. In general, m-commerce refers to any transaction with a monetary value that is conducted via a mobile telecommunications network. According to this definition, m-commerce represents a subset of all e-commerce, including both business-to-business and business to consumer. M-Commerce uses the internet for purchasing goods and services as well as sending and receiving messages using hand-held wireless devices. Wireless web applications will enable users with Internet enabled cell-phones.

M-Commerce is believed to be driving fundamental changes in the way business is conducted in many industries, particularly in telecommunications, information technology, media and financial services. M-commerce is so important because it represents the extension of the Internet beyond the static terminal of the PC, or even the television, into a more nimble, anytime, anyplace and anywhere context. It will enable millions of people to access web information services wherever they go (Yeo and Huang, 2003). It extends the reach of the e-services beyond the PC and the fixed network. M-commerce is so important for the following reasons:

1. The number of mobile terminals available is larger than the PC user base and is growing much faster.
2. User's intimacy with the terminals is higher. The terminal and service represents a more convenient and personal combination.
3. It is truly accessible anytime and anywhere.
4. It will enable employees to access information wherever they are and make decisions instantly without being confined to a desk or computer.
5. M-commerce eliminates many time-consuming tasks.

M-COMMERCE ENABLING TECHNOLOGIES

Technology suppliers are key market drivers for M-Commerce. There would not be significant growth in M-Commerce market until the necessary enabling technologies are developed and deployed (Mahatanankoon, et al, 2006, Simon, et al, 2006).

A. **Network Technologies:** A main barrier to M-Commerce is the limited network bandwidth and long call establishment time. This limitation will be eliminated when the mobile infrastructure is evolved into high-speed 3G networks. 3G brings together high speed radio communication (up to 2 Mbits/sec) and packet-based IP services into one, powerful environment. The higher bandwidth allows simultaneous access to voice, video and data services at once. Its packetized nature also enables “always on” mobility. This means that users can choose to be permanently logged on to email, Internet access and other services. The users are charged for how much information they send or receive, not charged for how long they are online.

B. **Service Technologies:** Short Message Service (SMS) and Wireless Application Protocol (WAP) have been the most popular mobile services that enable most of the M-Commerce applications today.

SMS has provided the ability to send and receive text messages to and from mobile phones. Each message contains up to 160 alphanumeric characters. Today, about 90% of SMS messages are voice mail notifications or simple person-to- person messaging. The rest is mobile information services such as news, stock prices, sport, weather, downloading of ringing tones etc. SMS is an ideal technology for pushing small amount of text information from one to one or one to many.

C. **Wireless Application Protocol (WAP) :** WAP is an open, interoperable framework for delivery of internet content and applications to mobile devices. WAP presents information in Wireless Markup Language (WML) format that is optimized for wireless handheld mobile terminals. WML is stripped down version of HTML and specifically designed for the small display of wireless devices. WAP also specifies a gateway between the wireless network and the wire line Internet, providing protocol translation and optimizing data transfer to and from the wireless devices.

SMS and WAP are mainly designed for low bandwidth 2G network. The high bandwidth 3G network will spark off new generation of instant messaging and multimedia streaming services.

D. **Mobile Commerce Terminal:** The mobile devices are largely distinguished into 4 categories.

- Mobile phone with voice only capability (e.g. Motorola StarTac).
- Smartphone: a mobile phone with added applications and PC connectivity (e.g. Ericsson R380, Nokia 7110, Alcatel OneTouch)
- Communicator: A PDA- type equipment integrated with or attached to a mobile phone for data and voice (e.g. Nokia communicator 9110, Palm VIIx).
- Laptop PC: all sub- notebook sized equipment (e.g. Sony Vaio).

However, the borders between them are blurring. In addition to these devices, new smart phones are expected to be released that take full advantage of the technologies such as WAP, GPRS and UMTS. These devices will have larger displays and keyboards, a longer battery life, and micro browser functionality. This technology will introduce mobile multimedia messaging and will enable users to download and listen to music, watch videos, remote control their household appliances, video conferencing and play interactive games.

E. **Security Technology-** Public Key Infrastructure (PKI): Security is key- enabling factor in M-Commerce. The market leader in security for mobile commerce is Sonera smartTrust, who has offered Public Key Infrastructure (PKI) for cell phones since early 1999. By means of certificates,

certification authorities, asymmetric encryption and digital signatures, PKI enables secured mobile transactions through

- Digital signatures for authentication of customer and merchant.
- Non- repudiation of the involvement in the transaction.
- Strong Encryption.
- Integrity of the message
- Confidentiality.

The PKI is normally implemented on the SIM card without the smart phone.

- F. **Mobile Location Technologies:** The ability to locate the position of a mobile device is a key to providing geographically specific value- added information that stimulates mobile commerce. GPS (Global Positioning System) is one of the technologies that is embedded in some mobile device. GPS is a system that consists of 24 satellites circling the earth such that several satellites fall within line of sight for any GPS receiver on Earth. Since the satellites are continuously broadcasting their own position and direction, the GPS receiver embedded in the mobile device can calculate its position very exactly. Other mobile location technology determine the location of the smart phone by comparing the relative times of arrival at the smart phone, of signals transmitted by the underlying mobile network base stations.

The mobile location technology enables the distribution of highly valuable, localized information to mobile users. Applications include fleet management, vehicle tracking for security, tracking recovery in event of theft, telemetry, emergency services, location identification, navigation, location based information services and location based advertising.

- G. **I-Mode:** is a rival standard to WAP developed by Japan's NTTDoCoMo mobile phone networks. It is widely used in Japan and is being introduced in Europe as well. I-mode uses compact HTML to deliver content. It makes it easier for businesses to convert their HTML website to mobile service. I -mode uses packet switching, which allows users to be constantly connected to the Web, and users can receive constantly- broadcasted relevant information. It handles a lot of color graphics, which is not available on WAP handsets.

H. **Other Technologies for Wireless Applications:**

- a. **Radio Frequencies:** Radio waves communicate information from one point to another without relying on any physical connection. Radio waves are often referred to as radio carriers because they simply perform the function of delivering energy to a remote receiver. The data being transmitted is superimposed on the radio carrier so that it can be accurately extracted at the receiving end. Multiple radio carriers can exist in the same space at the same time without interfering with each other if the radio waves are transmitted on different radio frequencies. To extract data, a radio receiver tunes in one radio frequency while rejecting all other frequencies.
- b. **IEEE 802.11:** The Institute of Electrical and Electronics Engineers (IEEE) ratified the IEEE 802.11 High Rate. This standard provides much higher data rates of 11 Mbps while maintaining the 802.11 protocol for wireless LANs. The 802.11 protocol is extremely robust and feature rich. It defines all aspects of Radio Frequency Wireless networking, including sequence control and retry fields that minimize interference and maximize usage of the bandwidth available on the wireless channel. It allows a user to roam among multiple access points that can be operating on the same or separate channels. It has features that can maximize battery life in portable clients via power- management schemes. It defines a mechanism through which the wireless LANs can achieve Wired Equivalent privacy (WEP). If WEP is enabled then all the data transmitted over the wireless network is encrypted. 802.11 High Rate also promises multi- vendor interoperability amongst products with the same physical layer. This means that a user can purchase a wireless device from one vendor to communicate with another wireless device made by another vendor. This gives users a

freedom to choose the system that best meets their needs. Standardization also delivers lower cost components, which will translate into lower prices to users. Because of this, many vendors have moved to IEEE compliance. Many vendors now choose to implement DSSS because the IEEE 802.11 High Rate standard is based on DSSS technology as well. This makes migration from a 2 Mbps 802.11 DSSS System to an 11 Mbps 802.11 easy because the underlying modulation scheme is very similar.

- c. **Infrared (IR):** Infrared data connection is a cordless, widely available, short range, low cost transceiver signaling technology. It provides high-speed digital exchange through the typical PC UART/ serial port at 9.6- 115.2 Kbps, and in some units up to 1 Mbps and 4 Mbps speeds. (Fast Infrared is capable of transferring data up to 4 Mbps, whereas Serial Infrared can transfer data at 115 Kbps). IR uses very high frequencies to carry data. It cannot penetrate opaque objects. Inexpensive directed systems provide very limited range (one meter) and are typically used for PDAs, notebook computers and mobile phones. Using IR is as secure as using a cable at any other access point on the network. Diffuse IR allows many- to- many connections. It does not require direct line of sight and can be uni- or bi- directional. Nevertheless, the transmission is limited to individual rooms. Closed doors and private offices close network users off from one another. Direct IR is point – to point, typically one – to- one communication. It requires line of sight. The Infrared Data Association (IrDA) is a protocol suite designed to support transmission of data between two devices over short -range point - to - point IR at speeds between 9.6 Kbps and 4 Mbps. To be IrDA- compliant a product must be capable of maintaining a constant connection speed. The IrDA- compliant a product must be capable of maintaining a constant connection speed. The IrDA standard specifies a connection up to 1 meter, though many IrDA -compliant products can connect at distances greater than 1 meter. IrDA has ratified a higher – speed version of its current infrared wireless networking standard. This new specification increases the data transmission rate from 4 MBPS to 16 Mbps. Another progress is that IrDA has approved the Advanced Infrared specification which will let access points receive IR connections in a 180 degree radius from as far away as 10 meters and operate at data rates of up to 4 Mbps. These improvements may make IR devices more attractive in the business environment. IR is now showing up I several electronic products, such as PDAs, printers, desktop adapters, notebooks, cameras, and Palm devices. One of the reasons for this has been the simplicity and low cost of IrDA hardware. IR applications will soon be seen in photocopiers, fax machines, overhead projectors, telephones, bank ATM's, credit cards, game controls and headsets.
- d. **Bluetooth:** After several years of development, Bluetooth wireless technology comes into market in 2001. Bluetooth is a reference to the taming of a myriad of unruly competing standards by defining one worldwide specification. It is a short- range radio, energy saving, low –cost and safe wireless technology that allows voice and data connections to be made up to 10 meters. The range can be extended to 100 meters with an amplifier. The first generation of the technology delivers performance up to 1 Mbps. Subsequent versions may deliver anywhere from built in 2 Mbps to 12 Mbps of throughput.

Bluetooth is a universal de facto standards specially designed to integrate all sorts of personal electronic devices so that they can link and communicate easily and simply with each other. It frees users from using and connecting cables. To be bluetooth certified, a device must pass interoperability testing by the Bluetooth Special Interest Group. (SIG) It assures that products meeting the specification will be able to interact with all other Bluetooth –certified products and with the Internet. Bluetooth has built in sufficient encryption and authentication. It is very secure in any environment for both stationary and mobile devices.

Bluetooth works in the industrial scientific, and medical (ISM) band with frequencies between 2.402 and 2.480 GHz. It applies a frequency hopping mechanism where 1600 frequency changes occur every second. A single Bluetooth connection uses 79 different frequencies with channel separation of 1 MHz.

Bluetooth will catch on quickly with electronics manufacturers because it is an open specification that does not require them to pay royalties. It is relatively cheap to implement. SIG members include almost everyone involved in the computer and networking industries, and plenty of others such as kitchen appliance manufacturers. Any company can join SIG, but it must grant all other members a royalty-free license to use any Bluetooth technology it develops. This marketing strategy carries the messages of greater freedom, speed, security, simplicity, versatility, and reliability in connecting electronic devices.

Bluetooth lets you exchange such as PIM synchronization, connect to the Internet or LANs, or conduct e-commerce. Some of Bluetooth's benefits and possible applications include:

- Connections between notebook computers and cellular phones or PDAs for e-mail.
- Easy synchronization of data in applications running on laptops, handheld PCs and mobile phones.
- Wireless connections between headsets and mobile phones.
- Cordless connections that allow mobility during a connection.

Market Researchers Frost & Sullivan estimated that the Bluetooth devices would generate revenue in the European market of \$37 million in year 2000 and grow to \$700 million by 2006. Another researcher, the Cahners In-Stat Group forecasts the use of Bluetooth-enabled equipment will bloom from 1995 through 2005.

Bluetooth currently sends information at a relatively low speed 700 Kbps and its range is just 10 meters. Also, bluetooth sends signals at the 2.4 GHz band, which are subject to interference from microwave ovens and amateur radio operators.

- e. **Java:** Java is considered to be a revolutionary application implementation mechanism due to its robust object-oriented design, multi-threaded, distributed and cross-platform capability. These features are the key reasons of Java's success. Java code can be downloaded dynamically from remote servers and interpreted on-the-fly within a local application.

Currently, the Java 2 Micro Edition (J2ME) is the primary platform targeting the consumer and embedded market, specifically for small-scaled devices. J2ME is a minimum implementation of the Java platform, using minimal set of Java API and a scaled down Java Virtual Machine (JVM).

Java enables the development of very fancy but practical graphic user interface. Users enjoy the pleasant description and delivery of information and services, which facilitates effective communication. Despite the limited screen size and display capability of the hardware, Java can cooperate with the pre-defined hardware profile to implement arrow linkages and buttons, drop-down list and scroll bars so that the user interface is greatly enhanced. The most compelling advantages of Java are:

- Open, distributed platform based: Java is an end-to-end application solution. It is considered not only a user level interface, but also a solution architecture with flexible integration across the system.
- Supports dynamic download: Users can download applications on demand through wireless media. In addition, there is continuous application upgrade, such as new version of mobile games and PIM modules, so that users would not be required to delete the application and re-install it from the beginning. The Java Application Manager (JAM) in the mobile devices will automate and handle the download and installation on-the-fly.
- Provides offline processing mechanism: This is one of the most beneficial features of Java because many user operations do not need to connect to network and occupy the

charged channel. User can save money by having off- line processing of applications. Network resources can be more efficiently utilized as well.

- Easy to develop and maintain: With the Java hype in the IT industry, there are numerous Java developers, system integrators, solution providers and also researchers. The number is still rapidly increasing as Java is considered to be one of the most widely adopted solution paradigm I the next generation application and platform implementation. There are plenty Java references and resources in facilitating the development, making maintenance and support easier.

M-COMMERCE VALUE CHAIN

There are many players in the m- commerce market and the m-commerce value chain can be grouped into three major categories:

1. Technology developers
2. Technology applications developers
3. Service Providers.

- A. Technology Platform Vendors:** The technology platform vendors are delivering the operating systems and micro browsers for mobile devices such as smart phones and other communicators. Currently, the two dominating operating systems are windows CE of Microsoft and Palm of Symbian. The micro browser market is dominated by Phone.com who has lined up with nearly all-major mobile phone manufacturers, except Nokia and Ericsson, who are marketing their own micro browser products.
- B. Infrastructure Equipment Vendors:** Infrastructure equipment vendors develop the mobile network infrastructure equipments. The major suppliers are Lucent, Motorola, Ericsson, Siemens and Nokia. These companies have been developing solutions for mobile data and mobile Internet.
- C. Application Platform Vendors:** A particular key driver for providing wireless Internet applications is the availability of middleware infrastructure, that is , the WAP gateways at either the mobile operator's site or at the corporate customer's site. Application platform vendors are those companies who develop these WAP gateways; they include Phone.com, Nokia and Ericsson.
- D. Application developers:** Application developers are companies who develop applications for the mobile environment. At present, most of these applications are built around primarily on Windows CE and palm OS technology platforms.
- E. Content providers:** technologically advanced content providers are also moving into mobile space to be ready for when mobile commerce will happen. Mobile network is a new distribution channel for them and some big content providers like Reuters, Yahoo! and Excite are either forming alliance with mobile network operators or building their own mobile portals.
- F. Content Aggregators:** Content aggregators are companies who repackage available data for distribution to wireless devices. The added value is I delivering content in the most appropriate package.
- G. Mobile Portals:** Mobile portals are formed by aggregating applications (including e-mail, calendar, instant messaging) and content from various providers in order to become the user's main supplier for web- based information that is delivered to the mobile terminal. Mobile portals are characterized by a greater degree of personalization and localization than regular web portals, since the success of m- commerce applications is dependent on ease of use and on delivering the right information at the right moment.
- H. Mobile Network Operators:** Mobile network operators are those companies that are currently providing mobile telecommunications services, such as Mannesmann, Orange in Europe, PCCW and Hutchison in Asia. These operators are trying to move up the value chain by providing more mobile services.
- I. Mobile Service Providers:** Mobile service providers provide services to their customers via the mobile network and they may not necessarily own any infrastructure. However, growing number of mobile services providers have been acquired by large network operators to strengthen their position in the mobile commerce market.

- J.** *Handset vendors:* In general, customers do not shop for a particular service provider or network operator, but rather for the handset brand. Hence, the handset vendors are critical in the m-commerce value chain. Mobile phone has merged into not only a consumer electronic device, but also something as personal as a pen or watch. Mobile handset manufacturers are coming closer to the traditional PDA manufacturers, as they are both offering smart phones and communicators with combined functionality.
- K.** *Customers:* According to a study on mobile value added services conducted by Nokia, the primary target markets for m-commerce consumer services are
- Teenagers (18 years and under)
 - Students (19- 25 years)
 - Young business people (25-36 years)
- The business markets can be divided into three main categories of organization that possess distinct m-commerce needs:
- Sales driven organizations, such as manufacturing companies and banks
 - Service – driven organizations, such as consultancies and system houses.
 - Logistics- driven organizations, such as taxi companies or courier services.

INDUSTRIAL ASPECTS AND CONSIDERATIONS

Although the mobile industry is booming on the way, there are several issues that require professionals, users and solution/ service providers to explore and look into (Frolick and Lei-da-Chen, 2004, Urbaczewski, et al, 2003, Tarasewich, 2003). Application is the ultimate scene to integrate the capability of the hardware, the software and consumption expectation. Users can benefit a lot from well- designed and implemented application. But there exists embedded social concerns as well, such as billing mechanism and the abuse usage of beaming application among mobile users, which leads to the violation of billing rules and copyright problem. The highlights are

- *Application is about integration and cooperation:* As the provisioning of service involves several parties or industry sectors, the development of application requires the synchronization and good cooperation between entities. This includes defining of industry standards, migration to such specifications, content definition, mapping of milestones (the road map of the parties). For instance, when the J2ME application development just started to be a big boom, many service providers kicked off the projects without comprehensive planning for the long- term extension of the Java platform. While device manufacturers were still developing their Java enabled handheld, and the Java community was defining the industrial implementation specification, the forerunners had already cried for production and integration. Indeed, all these activities must be coordinated well. Otherwise, the development of new technologies will be hindered.
- *Good product design is important:* The scarce resources defined in mobile devices can cause ineffective usage and are annoying to the user. Poor design of browsers (the process to access the application, the data and the service), limited power and storage size, display quality, etc. all directly affect the service quality. Some PDAs have MP3 and /or video player, and are capable of receiving streaming multimedia data. However, the memory and power of these PDAs usually run out quickly. If the device's backup storage mechanism is poorly designed, the data that previously stored in the device will lose. This is very annoying to users.

On Sept.1, 2000 Wireless Web for Business was put on the market, featuring faster wireless Internet connections and special business tools.

Utilizing a combination of the new bandwidth technology and a Sprint PCS Dialer 2.0, customers can use their wireless phones as laptop modems and access the Internet with a connection comparable to 56.6 kbps. Also available are special adapters, which enable a phone to be plugged into standard Type II slots, thereby freeing up the serial port. Separate Wireless Web Modems can be purchased, which also fit into Type II slots.

In addition, Sprint PCS is introducing Wireless Web Private Network Connections, which provides employees with wireless connections to corporate networks in about 20 seconds or less. In conjunction with these releases, Sprint is marketing real-time, wireless phone access to corporate e-mail, directories and other business services and applications.

- *How and when to charge the user:* As mentioned earlier, if it lacks proven process design for the billing and control mechanism for provisioning of applications, such as beaming, service providers will lose such subscription asset. This also causes users to abusively download applications from the peers.
- *Understanding the User:* different user has different requirements and desire for the applications. Before deploying a service and application, the service provider should understand that different customer has different usage expectation, and this expectation is directly associated with the device they had intended to buy. For instance, there maybe a group of *Always wired* users who may require the applications to support high data speed wireless access to the Internet. They may also frequently communicate with fellows using mobile ICQ (MCQ). Therefore, they would expect the mobile menu and the micro- browser be easily used and evoked quickly.
- *Security and Privacy:* Many companies do not apply wireless technologies because they worry about the security problems. Improved interoperability of the wireless technologies means that the systems' connections and operating frequencies are predictable and easy to tap into. It opens up a chance of over – the-air packed sniffing. For applications that involve monetary transactions and personal data transmissions, security is always the prime consideration. There are many emerging and under-development technologies to enhance the protection of transmitting sensitive data, for instance, the integration of Java Card and Smart Card technology with mobile devices.
The other security concern is the protection of the handheld system data. From time to time, some applications abnormally function and in turn cause system data (and/or user data) to crash and corrupt, or lead to other embedded application failing to execute properly. Java's sandbox implementation is to isolate applications' data stack with each other, especially with the system. The methodology is claimed to be safe. However, sandbox cannot report an intrusion program though it prevents the program from attacking the mobile system. Then, one does not acknowledge the existence of the intrusion and the corresponding program.
- *Crowded Band:* The 2.4 GHz band is theoretically available worldwide. However, since Bluetooth and other wireless technologies are not the first communications system using this ISM band, this spectrum becomes very crowded. Indeed, some mobile phones, local loop system and most wireless networks use the ISM band.
- *Separation of Enterprise Data from Personal Data:* Business users popularly use mobile devices equipped with more corporate functions. They also store and manipulate much of his/her personal data in the device as well. Improper data management can cause these personal and business data being intercepted too much and lead to confusion. Therefore, the forthcoming management challenge will be separating enterprise data from personal data. Users should start planning for the management of mobile devices by developing policies and standards.

MARKET DRIVERS FOR M-COMMERCE

Mobile commerce is still at its infant stage and some people believe that it is still a market hype. Some people believe that the true uptake of mobile commerce will soon become a reality (Raisinghani, 2002) However, before that, the following key market drivers are crucial to the growth of the mobile commerce market.

- A. **Mass market mobile:** High penetration and usage of mobile telecommunications services is pre-requisite for the development of mobile commerce market. It is believed that the number of mobile phone subscribers is going to outnumber the number of fixed telephone lines, particularly in those developing markets, like Asia.
- B. **Booming wire line Internet:** E- commerce is growing rapidly throughout the world, as more and more people are getting online. Similarly, mobile commerce will be adopted rapidly with the high usage of mobile telecommunication services and when the wireless bandwidth becomes more or less a commodity. It is believed that with the highly personalized and the truly anytime, anywhere access

- features of mobile telecommunication reinforced by the increasing exposure to the fixed line e-commerce, the growth of m-commerce will be much faster than fixed line e-commerce.
- C. **Supplier push:** The push from equipment vendors for WAP gateways and the micro browser-enabled smart phones is helping to drive the market for mobile commerce. With the rapid pace of innovation in the mobile and Internet industries, it is believed that true uptake of m-commerce will become a reality soon, when both equipment availability and functionality are more mature.
 - D. **Licensing of network licenses:** The award of licenses for 3G, UMTS, etc. will play a critical part in the development of m-commerce market. Apart from companies from telecommunications industries like mobile service providers, companies from media and other strong marketing organizations are also planning to compete for the licenses in regard of the great revenue potential of m-commerce. Hence, the award of license will determine the competition and the pace of development of the mobile commerce market.
 - E. **Breakthrough in technologies:** Mobile commerce services have not achieved great prominence on current circuit-switched mobile phone networks. Technology's limitation on data speed and network capacity is the major hindrance for the growth of m-commerce. True explosion of the m-commerce market will happen with the introduction of new network technologies like 3G when these two problems can be solved.

MARKET SITUATION

A. Major players in the Industry:

1. *Device Manufacturers:* Device Manufacturers are the hardware handheld makers and system providers. Some of the giants may also get involved in the industry standards design and definition, which are used to work closely with the software specification and application environment. Famous leaders are Nokia, Ericsson and Motorola.
2. *Application Providers:* These solution providers integrate the output of content provider and mobile devices for end-user applications. Major players in this area include Active Sky Video and Animation, CNET Handheld software, PalmGear etc.
3. *Content Providers:* Content providers are the cores of the application usage. Generally speaking, organizations (government or industry institution), service centers, research centers, agencies, financial bodies, entertainment companies, portals, commercial entities, banks all can be content providers.
For instance, streaming applications require content providers to deliver personalized or commercial movies, films for leisure enjoyment. On the other hand, the application can also be financial centric, providing real-time stock trading information. In such case, the content providers would be financial institutions, Hong Kong Stock Exchange and banks.
4. *Service providers (Operators):* Service Providers are the platforms for the delivery of applications and services to end-users. Billing, or payment of service subscription happens here and users access wireless solutions through the network of the operators. Some well known operators include Vodafone, NTTDoCoMo, Spring PCS etc.
5. *Users:* End-users, the customers, of course will be the passengers and drivers as well, for the wireless application industry to move on. From service providers' and makers' point of view, mobile users can be categorized to several groups, so that the specific needs and consumption behavior can be mined to improve the hardware, application and service quality.

B. Wire less Applications:

Mobile devices will enable product and services to be offered direct to an individual's 'pocket,' facilitating more tailored product and service offerings than Internet access via the PC. Among the wireless data applications, multimedia messaging will still remain as the most common

applications in the wireless world. Other major wireless applications are entertainment, financial services and location –based services.

1. *Financial Services:* Mobile banking services, which are an extension of Internet banking (or home banking), allow customers to use digital signatures and certificates
 - To manage personal account information (account history, transfers);
 - To transfer funds in bank accounts or pre- paid accounts
 - To receive alerts regarding bank information or payments due, and
 - To handle electronic invoice payments.

Each of these services, secured end to end, can be performed from the handheld units which could be a smart phone, PDA or any mobile terminals. The consumer would no longer need to go to an automatic teller machine, to wait for a call center operator or to log on to a computer. As for the banks, they can enhance their service level and reduce cost by minimizing calls at call centers.

2. *Travel and Tourism:* With enhanced messaging and location –based mobile service, offered by mobile operators and enterprise travel companies, travelers get in touch with all traveling tips, news, financial information, weather and ticketing anytime and anywhere. For example, if a crisis arises while traveling (a flight delay or diversion), new mobile phone services can enable travelers to better cope with disruptions, services could include displaying and booking alternative flights. Location specific services such as listing nearby hotels with room availability, local restaurants and taxi companies will also attract travelers. Several European airlines are experimenting with wireless Internet access devices, including Finnair with Razorfish, and British Airways and Swiss Air with IBM.
3. *Retail:* In the retail trade industry, the possible uses of wireless Internet access devices are almost limitless. Shopping applications will enable regular Internet e-commerce via a mobile phone, that is , the booking and ordering of, and paying for , physical goods and services from e- shops, virtual malls and portals. Another possible use is the confirmation of payment for goods in the physical world. For instance, in shops where the user interacts directly with a cashier or a vending machine. Trials in 1999 included services such as ordering red roses on Valentine’s Day and pointing a mobile device at a barcode in a shop and being told where the same goods are available more cheaply anywhere or within a 10- mile radius. In addition, shops can utilize mobile technology to target individuals with special offers as they walk by.
4. *Ticketing:* An electronic ticket for an event or travel results from transactions that involve booking, purchasing, invoicing, payment and receipt. Optional service delivery could supply virtual tickets. These could be used with a wide range of businesses.- airlines, railways, mass transit, toll way authorities, theaters, sporting event organizers, theme parks and so on.
5. *Entertainment and gambling:* One of the more appealing groups of applications for mobile e-commerce is likely to be entertainment. The service provider will supply a means for users to pay or sign contracts electronically. This might involve the user of payment or charging mechanisms such as prepaid games, or direct charging via the users pone bill. All manner of gambling is possible with pay-per-game or betting features. Online games, adventure games, and other services with pay-per-game features should also port well to mobile e-commerce.
6. *Personal Information Management (PIM):* PIM applications allow users to manage their daily information and events easily and in a simple way. Examples include e-mail (with or without voice capability), dictionary checking, calenaring, contact list, To- do- list, event reminder and data storage management. Typically, PIM cooperates with third party software or modules like Lotus Notes and mail messenger. Synchronization of handheld information (like contact list, email and task list) to personal computer or other lab- top computer is also essential. An embedded capability is usually installed in mobile device, especially PDAs. Applications such as ActiveSync and HotSync are very popular in today’s handheld devices.
7. *Location Based service:* Location based application is a revolutionary service for the popular mass. Users can get instant information based on their current geographical position or location district. One of the most compelling applications is the provisioning of localized shopping malls, bus stops, banks and hospitals). This kind of information can also be personalized. In the United States of America location based service that uses GPS, Time of Arrival (TOA) and Angle of Arrival(AOA) technology have already been put in automobile

for emergency help and positioning. This kind of service is a perfect fit with mobile application design, in terms of the anytime, anywhere concept.

M-COMMERCE CHALLENGES AND FUTURE EXPECTATIONS

M-Commerce could be developed to become strategic weapons for businesses to improve their competitiveness. Several previous researches have explored such opportunities (Gressgard and Stensaker, 2006, Smith, 2006, Andreou, et al, 2005, Buellingen and Woerter, 2004, Matthew, et al, 2004). Some important challenges are:

- A. M- Commerce services have not been as rapid in the US as in Japan and Europe.
- B. Keyboards and screens on cell phone are tiny and awkward to use.
- C. Data transmission speeds on existing wireless networks are very slow, ranging from 9.6 Kbps to 14.4 Kbps compared to a modem of 56Kbps.
- D. Most Internet enabled phones have minimal memory and limited power supply.
- E. Web content on wireless phones are mostly in the form of text with very few graphics.
- F. All web sites have still to configure their services to display text in such a way that it can be accommodated on cell phone screens.
- G. Unlike Europe and Japan, Wireless networks in the US are based on several incompatible technologies (CDMA & TDMA standards).
- H. For M- Commerce to take off, more Web- sites need to be designed specifically for wireless devices.

Many mobile applications are downsized desktop applications. However, the design and implementation is so complicated that the process involves numerous parties in the industry to work together (Jarvenpaa, et al, 2003). With the evolving and charming wireless technologies and solution paradigm (such a WAP, Bluetooth Java, XML, compression technologies (MPEG4, RMF), users can enjoy more user –friendly and personal supportive applications before long. The future of wireless applications and their development environment include

- A. *Open Platforms and Solutions:* Contrasting to the traditional legacy system and solution design, the entire IT industry is moving towards an open system and architecture of application design, catering for high productivity and flexibility of solution implementation, integration and maintenance requirement. Wireless application design is also targeting for “one application, run on any mobile handheld.” Same principles apply to the data synchronization. Like “one stop shopping,” users also want to update information through a single point of access. If the user has his/her personalized profile in a handheld, changing a new device should not require him/her to do the same configuration again in future.
- B. *All –in- one device, with rich application package (multimedia):* Mobile usage is popular because it brings much convenience and flexibility to users. It eliminates the geographical limitation and time constraints. It is foreseeable that the mobile devices will cooperate closely with other electronic devices and media, gradually forming a convergence of device capability. In future, users can perform multiple tasks by using just one device. We expect that mobile device may integrate with not only phone and simple data presentation device, but also with higher quality of multimedia interfaces, such as digital camera, MP3 player, video streaming and conferencing, fax, printing, home controller, etc. Consequently, the applications will become more comprehensive and feature to support the various functionality and interactions among different applications and systems.
- C. *Personalization:* Obviously, personalization is a powerful feature because applications and service providers can identify users’ specific needs while users on the other hand can have a better and greater control on their personal mobile devices.
- D. *Right form factor:* All applications require a good form device and channel to empower their functionality. Mobile devices are often used in a dynamic environment where the user is engaged in multiple activities. Therefore these devices must present the best possible user interface for quick and simple usage. Input methodology (by keys, hand- writing or voice) is one of the crucial subjects. It is not possible for users to input data and requests using long and complicated procedures and key sequences. Mobile devices must be simple so that users are not required to focus on their devices in the way they are using a desktop computer. These devices should have no installation scripts and complicated menu structure. Screen design, weight and size of the device are also important.

MARKET DEVELOPMENT PROCESS FOR M-COMMERCE

Currently, Europe has the highest mobile penetration, followed by Asia. Furthermore, both Europe and Asia (except Japan) are able to adopt a single standard, GSM (Global System Mobile Communications) that dominates the wireless world throughout these two continents. Though most of the key e-commerce trends and business models are derived from the United States, the US has not been able to reach a single standard and thereby, retarding the development of mobile services.

- A. *Some figures about the Industry:*** The most widespread view in the industry is that future demand for data services will create a whole new revenue stream for mobile operators and drive 3G deployments. This view is based on the current huge volume of data traffic on the fixed network generated by the Internet, will be migrated to the wireless network. While NTTDoCoMo in Japan is planning to launch the first 3G mobile system in May this year, other countries with maturing wireless market, like South Korea and Hong Kong will be awarding 3G licenses in 2001 and 2002. The 3G user base in the region is expected to reach 8.8 millions in the year 2003, with users predominantly being Japanese and Korean. However, by the year 2005 when most countries in the region will have launched their respective 3G systems, the user base will have soared to 27 millions, growing at a rate of 35%. The 3G-user base will represent 7% of the total wireless user base (380 millions) in the region by the year 2005.
- B. *In the United States of America:*** As per the report based in the year 2001, a survey of 351 professionals from META Group Inc., a worldwide I.T. Research and Consultancy firm in Stanford, Connecticut based also in North Amsterdam, Europe, Middle East/ Africa and Asia Pacific, Wireless and mobile transactions will account for nearly 20% of B2B transaction volume and 25% B2C traffic by 2003. This year's study reveals budget expenditures for wireless initiatives still a low percentage of overall IT budgets as per the report's author, Jack Gold, Vice President in the META Groups Web and collaboration Strategies (WCS) advisory service. Other key findings of the study include-
- Business- Critical applications are driving wireless initiatives.
 - Wireless planning processes are common in enterprises currently.
 - Organization with heavy use of pervasive devices by employees are more aggressive in implementing leading -edge wireless mobile infrastructure components. The first priority of implementation is for Business to Employee applications because these applications deliver immediate productivity return for organizations.
 - Users want vendors to deliver business value and not just technology. Customers also expect vendors to take responsibility for ensuring their products and services work as promised in actual implementations.
 - Pervasive device preferences will be in great flux during next 2-3 years. Vendors must be prepared to support many forms including feature based smart phones, PDA devices and notebooks.
- C. *Outlook for Asia:*** With the advent of 3G wireless network and other enabling technologies, the outlook of M-commerce is very promising, especially when the mobile operators around the world spent the huge 3G license fee, they have to strike very hard to promote M- Commerce so as to increase the Average revenue Per User (ARPU). The consulting firm, Ovum, expect the global wireless subscribers will increase from 469 millions in 2000 to 1192 millions in 2004. In the same period the number of M-commerce buyers will also increase from 22 millions to 373 millions. More than 17 million wireless customers signed up for mobile service in the Asia- Pacific region during the second quarter of 2000, according to Dataquest Inc., a unit of Gartner Group Inc. At the end of June 2000, the total number of wireless users in Asia Pacific had grown to 188 million subscribers. The current user base is expected to reach 380 millions by the year of 2005. By the end of 2010, it will exceed 486 millions.
- *Japan I-Mode:* The Japanese I-mode data services have captured the world's imagination and the potential for M- Commerce. Offering just 9.6kbps, NTTDoCoMo has already created the most advanced mobile Internet market with its I- mode wireless Internet service which has drummed up more than 18 million subscribers in less than 2 years, and is extremely

profitable. Teenagers sit in cafes and subway cars, eyes glued to tiny phone screens, thumbs pressing rapidly at the keypad. They use I-mode to send messages back and forth, download cartoon characters, check bank balances and search for apartments. I-mode gives mobile phone users constant access to the mobile Web using an open platform that make access to their services faster, more convenient and easy to use. There are more than 1000 official sites, and another 19000 unofficial sites, which are I-mode compatible.

- *China- The largest future mobile market:* China is already the second largest market with around 85 million mobile users, and many analysts predict over 250 million subscribers by 2005. China Mobile (Hong Kong) is a subsidiary of China Telecom and has 65 million subscribers at June 2000. At the same time, its competitor China Unicom Ltd. has 20 million subscribers. Given the great wireless subscribers base in China, can the success of I-mode be replicated in China? Due to cultural, technological and geographic differences, the model cannot be simply copied from Japan. In Japan, the mobile phone system has become more popular than fixed line systems due to high expense of fixed line phone installation (at over US\$600), the early use PHS phones that were very cheap, and the high transportation time. Due to lengthy transportation time, many Japanese teenagers access the Internet with I-mode, send messages, and download their favorite cartoon characters or tune, it is little wonder that I- mode has become so popular in Japan. Even with a high wireless subscriber base in China, it is unlikely that the I-mode experience can be duplicated in China. The lifestyle, transportation time, and income allocation o mobile services by Chinese are all different from that of Japanese.

CONCLUSION

Over the past few months, the Business Record has reported on the rapid expansion of the wireless communications industry, which analysts say continues to flourish. Ticketmaster.com, E*Trade, travelocity.com and dozens of other companies are scrambling to repackage their Internet services so they can deliver them wirelessly to cellular phones, two- way pagers and PDAs such as the Pocket PC and the palm hand- held device. Their target: the ultimate impulse buyer, the kind of people who shop and do business wherever they happen to be –in cars, restaurants, airplanes, the back seats of taxicabs and just about any other place where personal computers are not readily available. Without a doubt, the wireless market is growing quickly, and with it the demand for wireless commerce.

Therefore, the future of M- Commerce is very optimistic. Global wireless subscribers are expected to reach between 1.5-2 billion by the year 2010. There will be more wireless Internet users than fixed line users, and there will be more mobile phones than fixed line phones by 2003. Mobile communication will be an essential leg of the information infrastructure to connect people to the information sphere while on the move. M- Commerce can transform people's lifestyle with unique, personalized and location based services. People will be able to order movie tickets on the go, find directions instantaneously, use the phone to pay for coke from vending machines, access the Internet, send email while relaxing on the beach, and have access to the office scheduler from anywhere, anytime.

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